REMARKS

Reconsideration and allowance are respectfully requested. Claims 1, 9 and 17-34 are currently pending. Claims 1, 9 and 17-34 were rejected in the Office Action dated April 23, 2004. Claim 1 has been amended to correct some minor typographical errors. Revisions to Figures 3 and 5 are also submitted to correct typographical errors. No new matter has been entered.

I. §103(a) Rejection based on Takeuchi and Hong

Claims 1, 9 and 17-34 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,072,904 to Desai in view of U.S. Patent No. 6,038,340 to Ancin. Based on the following remarks, Applicants respectfully traverse this rejection.

A. The Present Invention

The present invention discloses a system and method for clustering related objects within an image together so as to aid the subsequent analysis of the image.

For instance, a document may undergo basic image processing so that text objects within the document which are close to each other are clustered together to form paragraphs. Such text processing of document images, whereby text is merged into paragraphs, is easy if the separation or distance between paragraphs is significantly larger than the gap or distance between the individual letters. However, if the gap between letters is less than the separation between paragraphs, as is often the case in a document containing many fonts and sizes of text, then basic or conventional image processing may not be able to successfully cluster all the text into paragraphs.

To overcome the above problem, Applicants developed a system and method for clustering related objects within an image based not only upon the proximity of one object to another, but also upon boundaries within the image that separate image regions of different characteristics. More specifically, amended Claim 1 calls for an image processing

system for producing clusters of related objects within an image, including:

> means for supplying a multi-level digital representation of an image;
>
> means for identifying predetermined objects in the image from the multi-level digital representation of the image and supplying data defining the locations of the objects;
>
> means for deriving boundary data from the multi-level digital representation of the image, the boundary data representing boundaries between regions of the image having different characteristics;
>
> means for clustering the predetermined objects into groups of related objects as a function of the proximity of the objects to each other and as a function of the boundary data; and
>
> means for supplying data relating to the groups of objects for subsequent analysis

(emphasis added).

B. The Desai Reference

In contrast to the invention as called for by independent Claim 1, the reference of Desai simply discloses a system for organizing and storing a plurality of images within a database, with any subsequent stored image capable of being quickly retrieved based upon a target image input by a user. Desai accomplishes this by analyzing and characterizing each image within its database based upon a pattern of edges contained within the image. Images having similar edge characterizations are subsequently "clustered" or grouped together for organizational purposes so as to improve the speed at which the database can be searched and an image retrieved.

Specifically, Desai utilizes various techniques for detecting the edges within any one image. "Each detected edge is subsequently characterized as being either vertical,

horizontal, left-diagonal, or right-diagonal." Then, "each point or picture element (pixel) in the image is identified as being on an edge or not, and if on an edge, which of four directions the edge is oriented." "The image is then decomposed, or partitioned, into separate blocks." Then, a "histogram of the characteristics of the pixels within [each] block is computed." (See Desai, 3:25-55) Consequently, each image becomes characterized by a plurality of histograms representing varying edge types. This plurality of histograms for any one image is then converted into a vector or matrix that represents "a characterization of the edges, rather than the edges themselves" for that image. (See Desai, 3:66-4:1) Furthermore, "different images may have similar edge characteristics even though they do not have similar edges." (See Desai, 4:2-3) The plurality of images stored within Desai's database are then "clustered" or organized into groups on the basis of the associated vector or matrix data representing "a characterization of the edges" for any one specific image. Thus, for example, a database containing an assortment of photographs may be organized so that all the portrait photographs of a person are "clustered" together into a first group, while all the landscape photographs are "clustered" together into their own group. (See Desai, 4:45-50) The speed of any subsequent search of the database can then be optimized by limiting the search of the database to the "cluster" or group of images most similar to the target image. (See Desai, Abstract)

Accordingly, Desai is found to neither disclose nor suggest an image processing system or method that includes "means for deriving boundary data ... representing boundaries between regions of the image having different characteristics", as well as "means for clustering the predetermined objects [within the image] into groups of related objects as a function of the proximity of the objects to each other and as a function of the boundary data", as recited in Claim 1.

Instead, Desai simply discloses a completely unrelated method of storing and organizing individual images within a database based upon a matrix of data that is associated with each individual image and which represents a characterization of the edges for that individual image. Furthermore, Desai neither teaches nor suggests that the edge information for an individual image, as represented by the associated matrix of data, could be used to segment or partition an image in any way to derive smaller areas for further examination. Instead, Desai only discloses analyzing the edge data of an entire image for purposes of identifying and organizing that image into one of several groupings within a database.

C. The Ancin Reference

In contrast to the invention as called for by independent Claim 1, the reference of Ancin simply discloses a routine for detecting the black and white points within a color image so as to improve a scanner's ability to filter or isolate dark images, such as text, from a colored background.

Ancin accomplishes the above task by first utilizing an image partitioning routine that "divides a digital image … into a series of local image blocks". (See Ancin, 4:10 and Figure 8) Each defined block of the image is then analyzed by a pixel counter to "compute the number of black pixels and the number of white pixels in the selected block." (See Ancin, 4:16-20) A block validity testing routine then examines the number of black and white pixels within a block to "determine whether the block being processed contains sufficient numbers of black pixels and white pixels to classify the block as having dark text on a light background." (See Ancin, 4:37-40) A block that is classified as having dark text on a light background is then subjected to a "pixel clustering routine that uses a clustering technique to locate black pixel and white pixel groupings, separately." (See Ancin, 4:57-59) Clusters of black pixels are then defined within each block based on whether each individual black pixel within the block

is within a predetermined distance from a defined center of the cluster in the block. (See Ancin, 5:42-55)

Accordingly, Ancin is seen to neither disclose nor suggest an image processing system or method that includes "means for deriving boundary data … representing boundaries between regions of the image having different characteristics", as well as "means for clustering the predetermined objects [within the image] into groups of related objects as a function of the proximity of the objects to each other and as a function of the boundary data", as recited in Claim 1.

Instead, Ancin simply discloses a method whereby an image is geographically broken up into a predefined number of blocks without taking into account any of the varying characteristics of the multiple regions of the image. This imposition of a uniform grid of blocks upon the image, as illustrated in Figure 8, is simply done to facilitate the detection of white and black pixels within a color image.

D. Desai combined with Ancin

The Office Action asserts that Desai teaches all the elements of Claim 1 except for means for clustering predetermined objects within an image into groups of related objects as a function of proximity of the objects to each other, as well as a function of boundary data, and that Ancin teaches such means for clustering based on proximity and boundary data.

However, as discussed above, Desai fails to disclose or suggest any type of means for "deriving boundary data … representing boundaries between regions of the image having different characteristics." Indeed, Desai never even suggests segmenting or partitioning an image in any way on the basis of regions of the image having different characteristics so as to derive smaller areas for further examination.

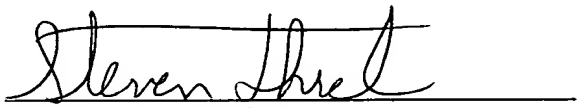
Similarly, Ancin discloses no such means for "deriving boundary data … representing boundaries between regions of the image having different characteristics." Instead, Ancin

simply divides an image into a predetermined number of blocks based upon a discretionary grid pattern imposed upon the image.

Accordingly, the references of Desai and Ancin, considered either individually or in combination, fail to disclose an image processing system that includes "means for deriving boundary data ... representing boundaries between regions of the image having different characteristics", nor "means for clustering the predetermined objects into groups of related objects as a function of the proximity of the objects to each other and as a function of the boundary data." For the above reasons, Applicants believe that independent Claim 1, along with its dependent Claims 17-26, are allowable over the references of Desai and Ancin, taken either individually or in combination. For similar reasons, Applicants believe that corresponding method Claim 9, along with its dependent Claims 27-34, are also allowable over the references of Desai and Ancin.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in condition for allowance, and a Notice to that effect is earnestly solicited.

Respectfully submitted,



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